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LONG RANGE SEISMIC MEASUREMENTS

DUMONT

19 MAY 1966

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

Washington, D. C.

15 SEPTEMBER 1966

By

EARTH SCIENCES DIVISION
TELEDYNE INDUSTRIES, INC.

Under

Project VELA UNIFORM

Sponsored By

ADVANCED RESEARCH PROJECTS AGENCY

Nuclear Test Detection Office

ARPA Order No. 624

LONG RANGE SEISMIC MEASUREMENTS

DUMONT

19 May 1966

SEISMIC DATA LABORATORY REPORT NO. 160

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Name of Contractor:	EARTH SCIENCES DIVISION TELEDYNE INDUSTRIES, INC.
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AVAILABILITY

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DUMONT
EVENT DESCRIPTION

DATE: 19 May 1966

TIME OF ORIGIN: 13:56:28.1Z

YIELD:

MAGNITUDE: 5.48 ± 0.56

LOCATION:

SITE: Nevada Test Site, Area U2t

GEOGRAPHIC COORDINATES:

Lat: $37^{\circ}06'40.0''$ N

Long: $116^{\circ}03'29.0''$ W

ENVIRONMENT:

GEOLOGIC MEDIUM: Tuff

SURFACE ELEVATION: 4195 ft.

SHOT ELEVATION: 1995 ft.

SHOT DEPTH: 2200 ft.

COMPUTED EPICENTER: ALL STATIONS

GEOGRAPHIC COORDINATES:

Lat: $37^{\circ}02'06.0''$ N

Long: $116^{\circ}07'19.2''$ W

TIME OF ORIGIN: 13:56:32.8Z

DEPTH: 48.5 km

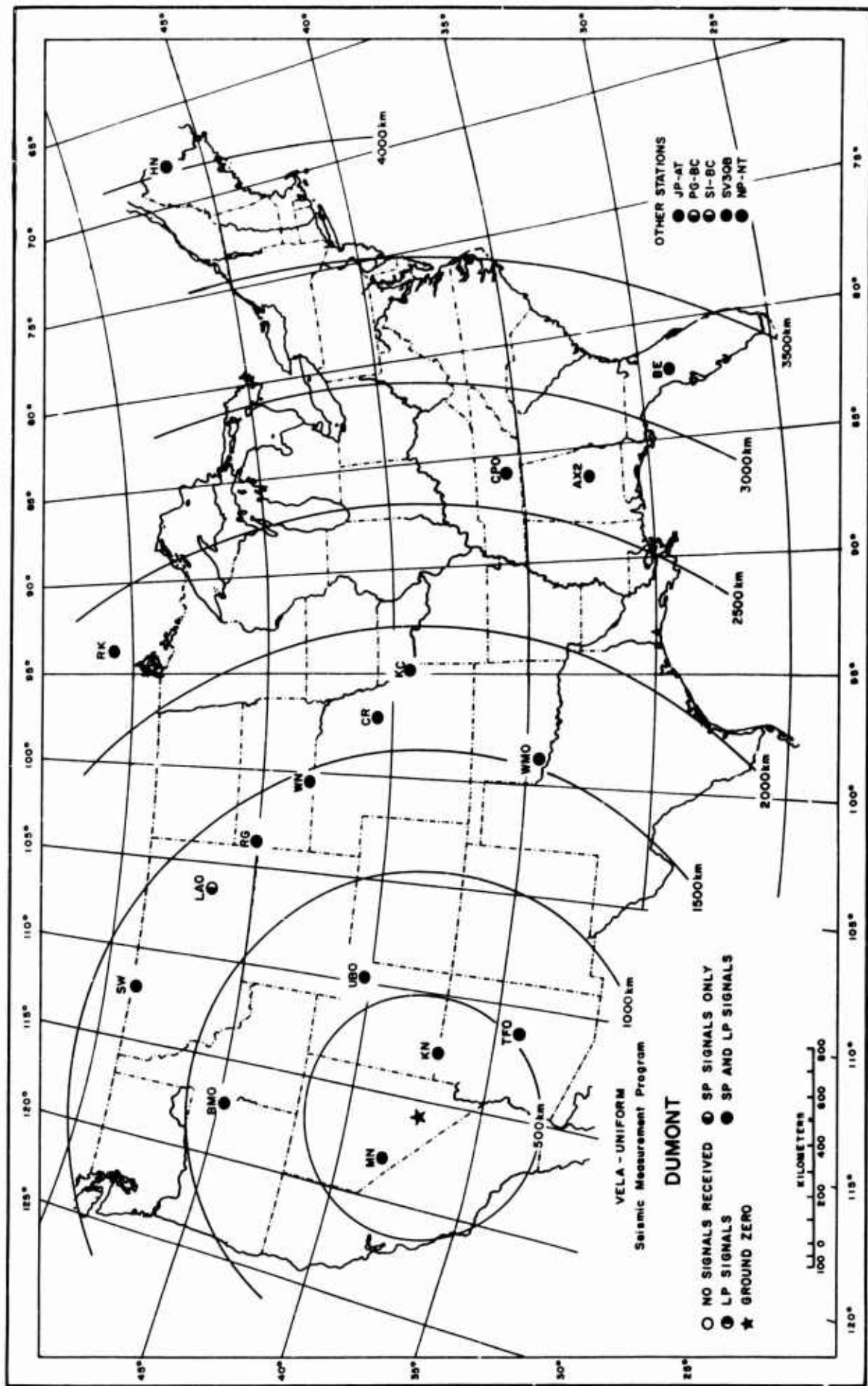
EPICENTER SHIFT: 10.2 km, S 34° W

Code	Station	Final						Tape	P
		SPZ	SPR	SPT	LPZ	LPR	LPT		
MN-NV	Mina, Nevada	+	+	+	+	+	+	*	
KN-UT	Kanab, Utah	+	+	+	+	+	+	*	
TFSO-ZI	Tonto Forest Observatory, Arizona	+	+	+	+	+	+	*	
UBSO-ZIO	Uinta Basin Observatory, Utah	+	+	+	+	+	+	*	
BMSO-Z2	Blue Mountain Observatory, Oregon	+	+	+	+	+	+	*	
IAO	Suparray, AO-10, Montana	+	N	N	N	N	N	*	P
SW-MA	Sweetgrass, Montana	+	+	+	+	+	+	*	P
RG-SD	Redig, South Dakota	+	+	+	+	+	+	*	P
WN-SD	Winner, South Dakota	+	+	+	+	+	+	*	P
WMSO-Z6	Wichita Mountain Observatory, Oklahoma	+	+	+	+	+	+	*	P
CR-NE	Crete, Nebraska	+	+	+	+	+	+	*	P
JP-AT	Jasper, Alberta, Canada	+	+	+	+	+	+	*	P
KC-MO	Kansas City, Missouri	+	+	+	+	+	+	*	P
PG-BC	Prince George, British Columbia, Canada	+	+	+	I	I	I	*	P
SI-BC	Smithers, British Columbia, Canada	+	+	+	I	I	I	*	P
RK-ON	Red Lake, Ontario, Canada	+	+	+	+	+	+	*	P
CPSO-ZR	Cumberland Plateau Observatory, Tennessee	+	+	+	+	+	+	*	P
AV-AL	Alexander City, Alabama	+	+	+	+	+	+	*	P
BE-FL	Bellevue, Florida	+	+	-	+	I	+	*	P
HN-ME	Houlton, Maine	+	+	+	+	+	+	*	P
SV-QU	Schefferville, Quebec, Canada	+	+	+	+	+	+	*	P
NP-NT	Mould Bay, Northwest Territories, Canada	+	+	+	+	+	I	*	P

I Inoperative + Signal
 N No Instrument - No Signal
 P Primary Timing * Magnetic Tape Available
 S Secondary Timing

Station Status Report - DUMONT

Table 1



Recording Stations and Signals Received

INTRODUCTION

A long range seismic measurements (LRSM) program and several larger seismographic observatories were established under VELA-UNIFORM to record seismological data resulting from natural seismic activity and a planned series of U. S. underground nuclear tests. The LRSM teams are mobile and occupy locations selected to provide optimum data from events of special interest; the observatories are permanent installations as follows:

Wichita Mountains Seismological Observatory (WMSO)
Lawton, Oklahoma

Uinta Basin Seismological Observatory (UBSO)
Vernal, Utah

Blue Mountain Seismological Observatory (BMSO)
Baker, Oregon

Cumberland Plateau Seismological Observatory (CPSO)
McMinnville, Tennessee

Tonto Forest Seismological Observatory (TFSO)
Payson, Arizona

Large Aperture Seismic Array (LASA)
Billings, Montana

The purpose of this report is to provide an analysis of data resulting from the DUMONT event recorded by the

LRSM teams and the VELA observatories and a preliminary summary of data reported by other permanent and temporary seismographic stations.

INSTRUMENTATION AND PROCEDURE

The instrumentation at each of the LRSM locations consists of three-component short-period and three-component long-period seismographs. In general, data are recorded on 35 millimeter film and on one-inch 14 channel magnetic tape although recently more portable instrumentation has been incorporated which records only on magnetic tape. The stations are all equipped to record WWV continuously to provide accurate time control and calibration is accomplished once each day and just prior to each shot at the operational settings. Pertinent information useful for analysis of LRSM data is available to qualified users of this data and is contained in Technical Report 65-43, "Interpretation and Usage of Seismic Data, LRSM program." General information on LRSM van and portable system equipment and operation is given in Technical Reports 66-27, "The LRSM Mobile Seismological Laboratory," and 65-74, "A Portable Seismograph." Copies of these reports may be obtained from DDC. The AD control number of Technical Report 66-27 is 480343. All the ob-

servatories have both long-period and short-period, three-component instrumentation, in addition to their other specialized facilities.

Station information is presented in Appendix I. This includes the station name and code; the geographic coordinates, distances and azimuths involved; the station elevations; and the type of instruments in use at each location. Representative instrumental response curves are shown in Appendix II(B).

The procedures used in measuring amplitudes reported herein is illustrated in Appendix II(A) and the unified magnitude is calculated as shown in Appendix I(B). The distance factors (B) beyond 16° are from Gutenberg and Richter^{*}. For distances less than 16° values were read from a curve in the Gutenberg and Richter paper back to 10° and then extrapolated to 2° , using an inverse cube relationship.

A standard hypocenter location program for a digital computer is used to determine the location using data from all stations analyzed. Best-fit values of latitude, longi-

^{*}Gutenberg, B. and Richter, C. F., Magnitude and Energy of Earthquakes, Ann. Geofis., 9 (1956), pp. 1-15

tude, depth of focus, and time of origin are determined statistically by a least squares technique. This utilizes a Jeffreys-Bullen travel-time curve as modified by Herrin in 1961 on the basis of Pacific surface-focus recordings. Precision of the computation is limited primarily by the accuracy of arrival times, the validity of the standard travel-time curve, and by local velocity deviations. Since the method is based on P-wave arrivals, this particular program does not make use of later phases such as pP and S in the determination of depth or location.

DATA AND RESULTS (LRSM and VELA OBSERVATORIES)

The parameters of the DUMONT event and a summary of the seismic evaluation is shown on the Event Description page. The operational status of the 22 LRSM stations and observatories is given in Table 1 and illustrated in Figure 1.

Table 2 summarizes the measurements made of the principal phases from the DUMONT event at the LRSM and VELA stations. Included are the Pn and P arrival times, the maximum amplitudes (A/T) of Pn or P motion and other phases as seen on the short-period vertical instruments. Long-period Love and Rayleigh wave motion are also tabulated in (A/T) form.

In addition, individual station Rayleigh wave areas (mm^2) is indicated as measured on the LPZ only. Although reduced to 1K magnification, they have not been normalized to any magnitude. Twenty-two stations recorded short-period signals. Long-period signals from this event were recorded by 19 stations.

The unified magnitudes determined from the LRSM and VELA observatories is shown in Figure 2. The average magnitude is 5.48 ± 0.56 .

The travel-time residuals from the Pn and P phases are shown in Figure 3. Figures 4 through 8 illustrate plots of the amplitude of P, Pg, Lg, LQ, and LR.

Attached to the report are illustrative seismograms showing the signals recorded at 4 stations. The most distant station analyzed that recorded DUMCNT was NP-NT at a distance of 4366 kilometers.

Principal Phases
DUMONT
14 May 1966
13:56-20:12

Code	Station	Distance (km)	Lat	Magnetic Location (° E from A 10)	Phase	Observed Travel Time		Period T (sec)	Maximum Amplitude A/T	Magnetic Amplitude (a)	Area (km ²) LPE
						(min)	(sec)				
MN-NV	Reno, Nevada	236			Pn	0	36.6	0.4	4172	5.88	1042.76
						0	38.7	0.45	14.375		
								(1.0)	(48.053)		
								---	---		
								14.0	2517		
KN-UT	Kanab, Utah	267			Pn	0	43.2	0.6	2718	5.93	113.33
						0	44.4	0.6	2549		
						0	48.1	---	---		
								---	---		
								14.0	1059		
TF50	Tonto Forest Observatory, Utah	535			LQ			12.0	2576	5.81	
UB50	Uinta Basin Observatory, Utah	667			Pn	1	33.7	0.9	760	6.48	65.88
						1	35.3	0.8	842		
						1	41.1	0.95	461		
						1	46.2	0.9	532		
						1	52.7	1.45	1681		
BMSO	Blue Mountain Observatory, Oregon	866			LQ			1.2	4873	5.43	375.00
								1.2	3114		
								15.0	182		
								15.0	(71.5)		
								14.0	219		
LAO	Subarray A0-10, Montana	1339			Pn	2	52.6	1.0	22.1	5.44	
						2	55.4	0.9	107		
						3	04.1	0.8	179		
						3	29.0	0.8	115		
						4	05.1	1.4	240		
SW-MA	Sweetgrass, Montana	1359			P	2	57.8	0.9	99.8	5.18	207.72
						3	01.3	1.0	182		
						3	03.4	0.9	99.3		
						3	10.0	0.95	228		
						3	22.1	0.8	133		
RG-RD	Redig, South Dakota	1381			P	3	28.9	1.0	136	6.11	136.27
						3	49.0	0.8	144		
						4	17.0	0.9	102		
								1.3	503		
								(1.4)	(485)		
MN-SD	Winner, South Dakota	1510			LQ			17.0	133	(6.16)	113.33
								17.0	42.9		
								12.0	350		
WM50	Wichita Mountain Observatory, Oklahoma	1597			P	3	26.5	1.3	124	5.58	50.95
						3	34.6	1.4	115		
						3	39.7	1.4	97.9		
						3	54.9	1.4	67.1		
						4	29.3	---	---		
CR-NB	Crete, Nebraska	1709			LQ			15.0	16.8	5.54	236.55
								1.65	619		
								1.65	391		
								18.0	138		
JP-AT	Jasper, Alberta, Canada	1762			P	3	46.1	0.6	8.0	3.86	401.83
						3	48.1	(1.0)	(180)		
						3	54.5	0.8	100		
						4	07.6	1.0	83.2		
						4	31.4	1.0	68.2		

Principal Phases - DUMONT

Principal Phases
DUMONT
19 May 1966
11:56:28.12

Code	Station	Distance (km)	Inst.	Magna- fication (x)	Phase	Observed Travel Time		Period T (sec)	Maximum Amplitude A/T	Magna- tude (m)	Area (mm ²) LPZ
						(min)	(sec)				
KC-MO	Kansas City, Missouri	1885	SPZ	50.2	P	3	58.8	1.0	(189)	(1.14)	260.17
			SPZ	50.2	e	4	02.5	1.3	402		
			SPZ	50.2	PP	4	12.7	0.65	94.8		
			SPZ	50.2	e	4	35.4	0.7	64.4		
			SPZ	50.2	e	4	56.1	(0.8)	(56.7)		
			SPZ	50.2	(Pq)	5	18.8	(0.4)	(101)		
			SPT	48.7	Lq			1.1	159		
			SPR	48.6	Lq			1.0	134		
			LPT	21.3	LQ			16.0	138		
			LPR	18.3	LQ			(14.0)	(257)		
			LPZ	3.96	LR			14.0	316		
PG-BC	Prince George, British Columbia, Canada	1943	SPZ	184	P	4	06.6	1.3	74.1	4.17	
			SPZ	184	e	4	09.3	1.3	306		
			SPZ	184	e	4	(11.8)	1.3	254		
			SPZ	184	e	4	54.6	1.6	48.2		
			SPZ	184	(Pq)	5	37.6	1.2	49.5		
			SPZ	184	e	6	06.7	1.4	50.9		
			SPR	139	Lq			1.7	141		
			SPT	147	Lq			2.15	271		
SI-BC	Smithers, British Columbia, Canada	2138	SPZ	177	P	4	27.7	(0.7)	(55.9)	(4.55)	
			SPZ	129.3*	e	4	23.2	0.7	103		
			SPZ	129.3*	e	4	30.6	1.3	374		
			SPZ	129.3*	e	4	36.2	1.3	236		
			SPZ	129.3*	PP	4	44.2	1.3	153		
			SPZ	129.3*	e	4	48.6	1.2	160		
			SPZ	129.3*	e	5	00.9	1.3	159		
			SPZ	129.3*	(Pq)	6	09.1	1.4	99.0		
			SPR	167	Lq			(1.9)	(85.8)		
			SPT	180	Lq			2.1	156		
RK-ON	Red Lake, Ontario, Canada	2341	SPZ	48.0*	P	4	45.5	0.8	467	5.77	64.08
			SPZ	48.0*	e	4	47.0	1.05	905		
			SPZ	51.5	e	4	52.1	0.9	118		
			SPZ	51.5	e	5	00.5	0.8	103		
			SPZ	51.5	PP	5	06.6	0.9	122		
			SPZ	48.0*	e	5	22.7	0.8	80.4		
			SPT	51.5	Lq			1.5	131		
			LPT	35.6	LQ			17.0	29.6		
			LPZ	45.1	LR			12.0	83.8		
CPSO	Cumberland Plateau Observatory, Tennessee	2730	SPZ-8	45.0	P	5	(21.8)	0.85	103	5.42	200.00
			SPZ-8	45.0	e	5	23.3	0.9	139		
			SPZ-8	45.0	e	5	33.4	0.9	87.4		
			SPZ-8	45.0	e	5	43.4	1.3	77.1		
			SPZ-8	45.0	PP	5	52.4	0.85	70.2		
			SPN		Lq			---	---		
			SPE		Lq			---	---		
			LPR	22.9	LQ			17.0	97.5		
			LPT	19.0	LQ			19.0	19.9		
			LPZ	1.0	LR			43.0	366		
AXZAL	Alexander City, Alabama	2764	SPZ	176.7*	P	5	(25.1)	0.75	128	5.58	314.07
			SPZ	176.7*	e	5	26.8	(1.0)	(291)		
			SPZ	176.7*	e	5	38.6	0.95	41.4		
			SPZ	174.1	e	5	40.9	0.9	42.9		
			SPZ	174.1	e	7	(07.1)	1.0	24.4		
			LPR	43.4	(S)	9	16.9	16.0	11.8		
			LPT	31.8	(S)	9	46.0	27.0	9.6		
			SPR	171	Lq			(2.4)	(194)		
			SPT	170	Lq			(2.4)	(314)		
			LPR	43.3	LQ			21.0	39.5		
			LPT	31.8	LQ			20.0	70.8		
			LPZ	3.98	LR			17.0	116		
BF-FL	Bellevue, Florida	2845	SPZ	13.2	P	5	09.7	0.8	83.0	5.52	292.25
			SPR	27.6	Lq			(2.3)	(127)		
			LPT	29.4	LQ			(34.0)	(9.9)		
			LPZ	4.29	LR			16.0	115		
BN-ME	Boulton, Maine	4366	SPZ	103	P	7	07.9	0.8	58.9	5.31	97.40
			SPZ	103	e	7	09.1	0.8	102		
			SPZ	103	e	7	10.4	0.9	67.4		
			SPZ	103	e	9	11.0	0.7	11.7		
			SPZ	103	PeP	9	32.2	0.8	17.8		
			SPT	89.8	Lq			2.0	106		
			LPT	8.0*	LQ			16.0	129		
			LPZ	26.0	LR			13.0	82.6		
SV-NB	Schafferville, Quebec, Canada	4148	SPZ	108	P	8	16.2	0.9	83.7	5.42	57.90
			SPZ	108	e	7	18.2	0.8	139		
			SPZ	108	e	7	24.0	0.8	36.6		
			SPZ	108	e	7	31.8	0.9	19.5		
			SPZ	108	e	7	44.1	0.9	42.8		
			SPZ	108	(PP)	8	(44.4)	1.0	22.0		
			SPZ	108	e	9	11.2	0.75	14.5		
			SPZ	108	e	10	(28.1)	0.9	8.7		
			SPT	111	Lq			2.4	99.7		
			SPT	120	Lq			(2.2)	(55.2)		
			LPR	28.0	LQ			14.0	37.0		
			LPT	29.6	LQ			(14.0)	(19.3)		
			LPZ	36.7	LR			16.0	46.7		
NP-NT	Nould Bay, Northwest Territories, Canada	4364	SPZ	128	P	7	31.1	0.9	179	5.05	395.28
			SPZ	128	e	7	35.6	0.9	114		
			SPZ	128	e	7	44.8	0.75	82.4		
			SPZ	128	PP	8	58.9	1.5	150		
			SPZ	128	PeP	9	38.4	0.95	56.2		
			SPT	202	PeS	11	26.9	1.4	32.8		
			SPR	206	Lq			2.75	167		
			SPT	202	Lq			2.8	239		
			LPR	7.0	LQ			18.0	42.8		
			LPZ	12.7	LR			18.0	105		

A/T = sec
--- Maximum Amplitude Clipped
on Film and Magnetic Tape
? Doubtful Values
or Phases
* Measurements made from
Playouts

Principal Phases - DUMONT

Table 2 - Page 2

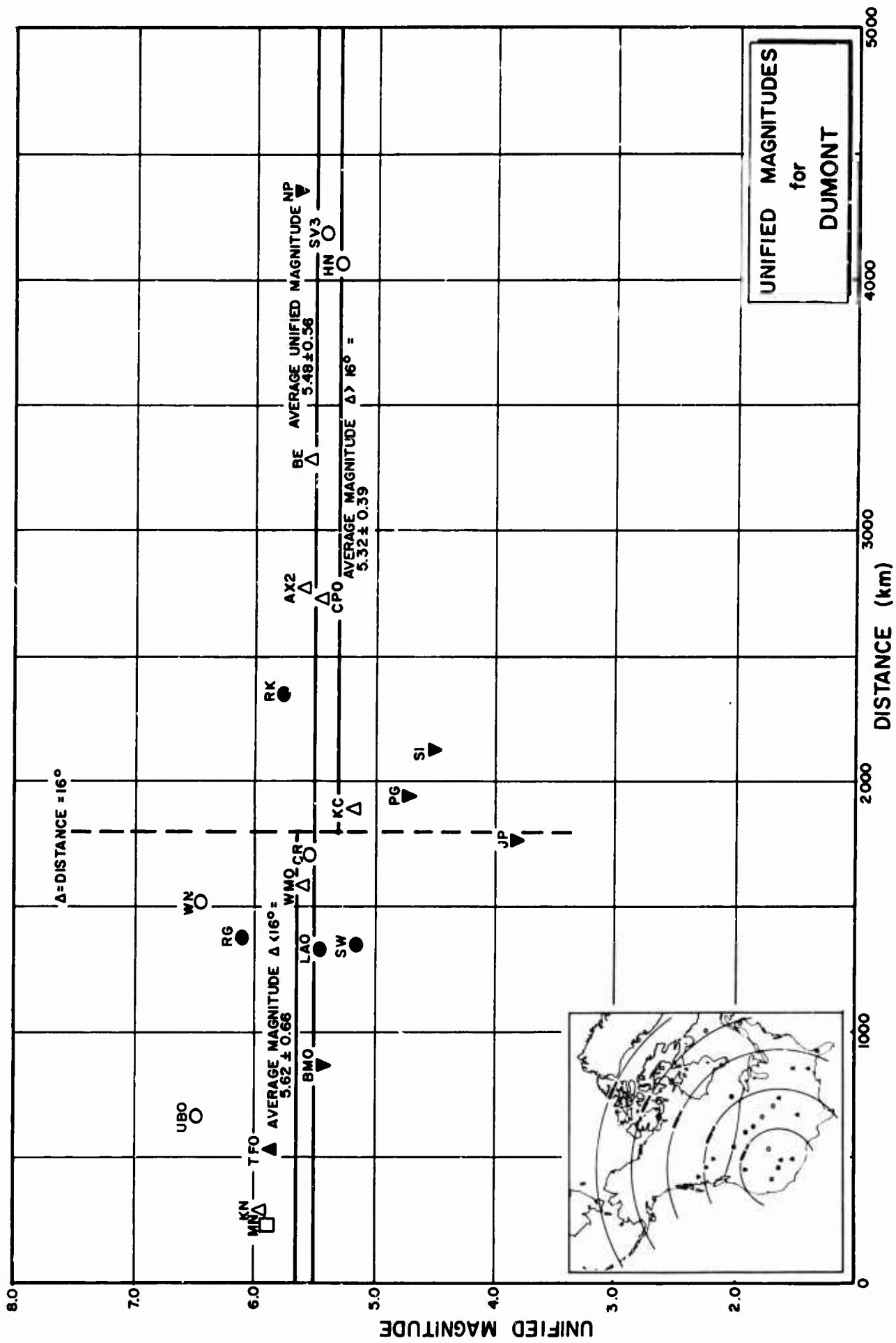


Figure 2

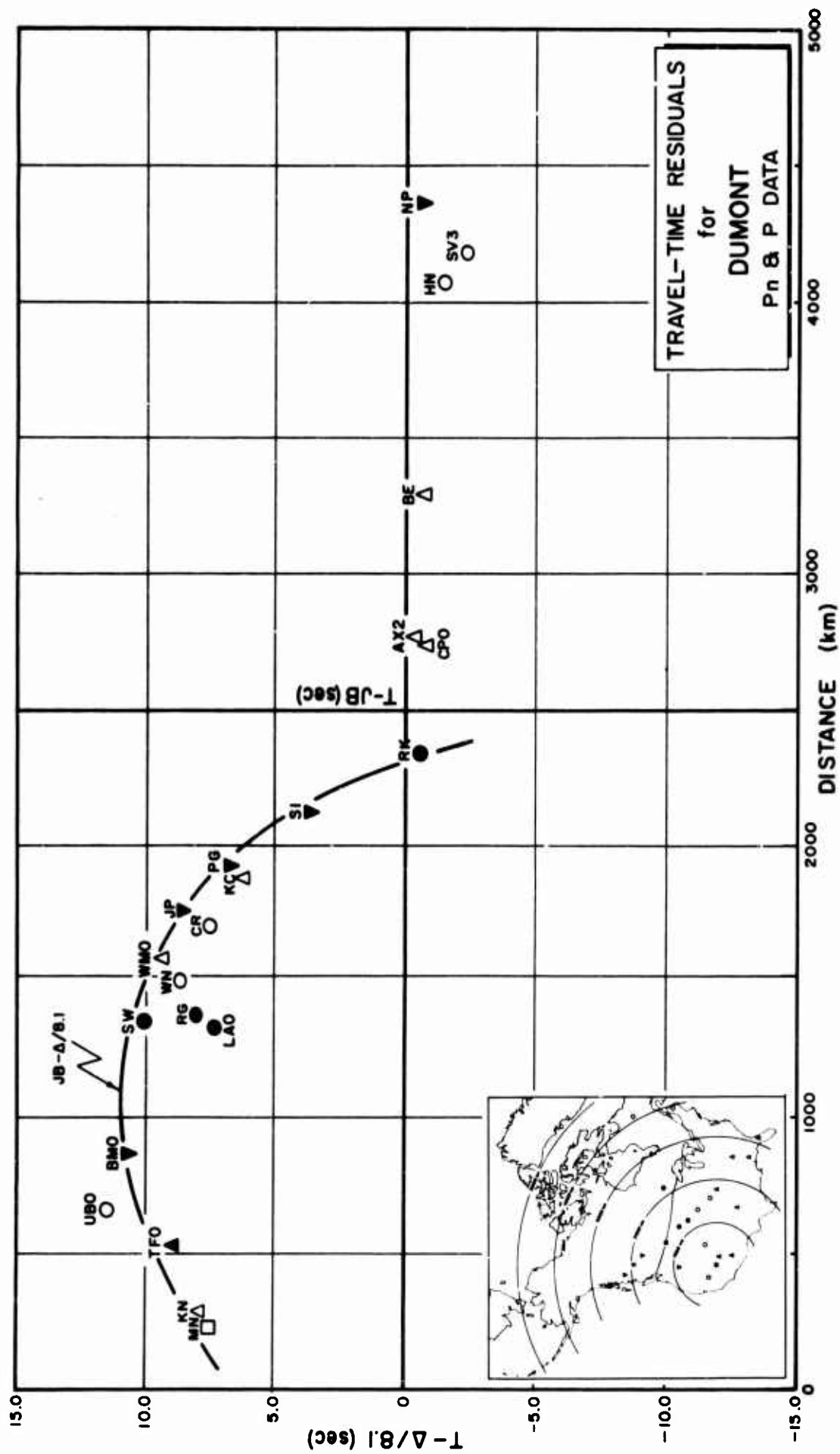


Figure 3

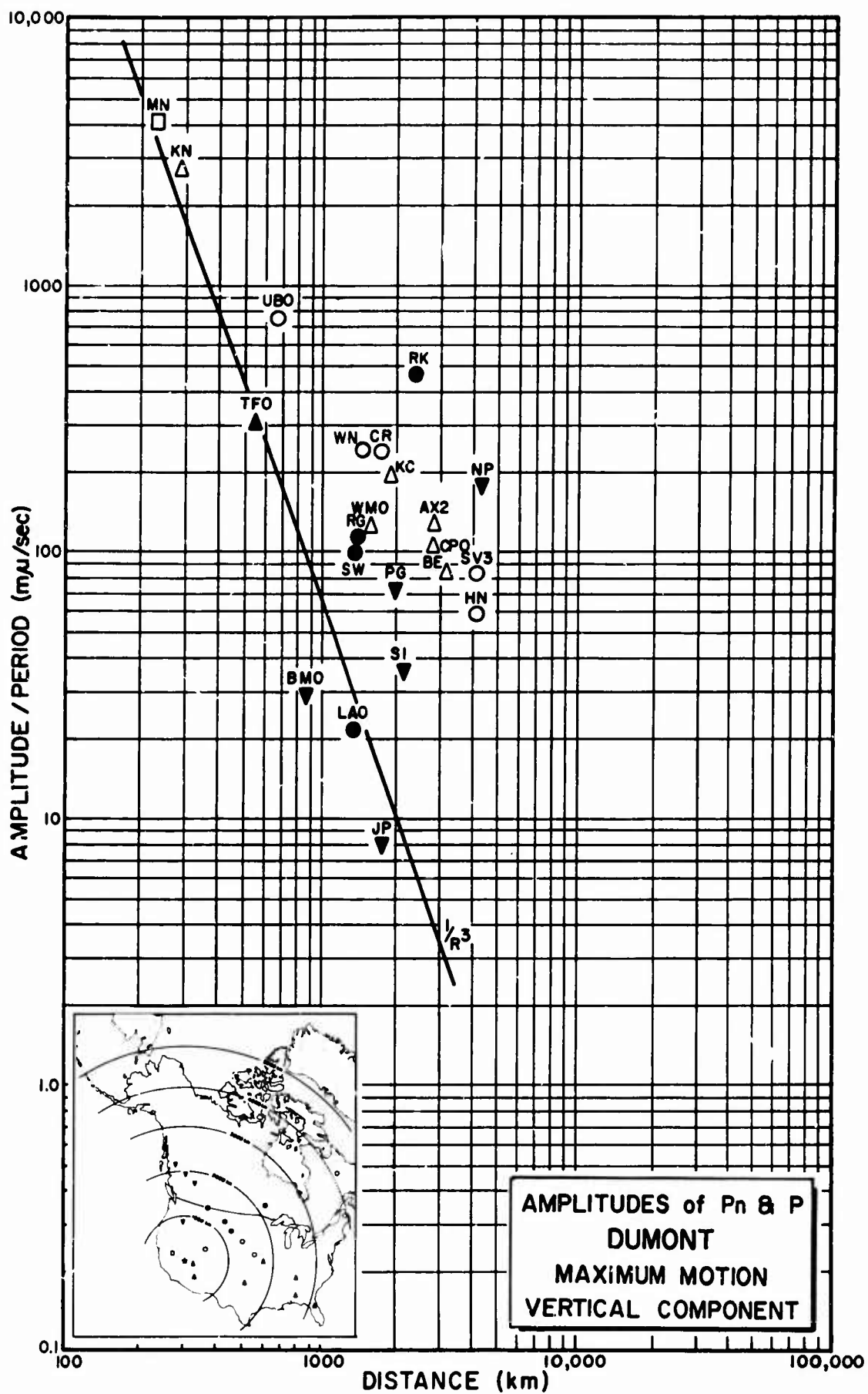


Figure 4

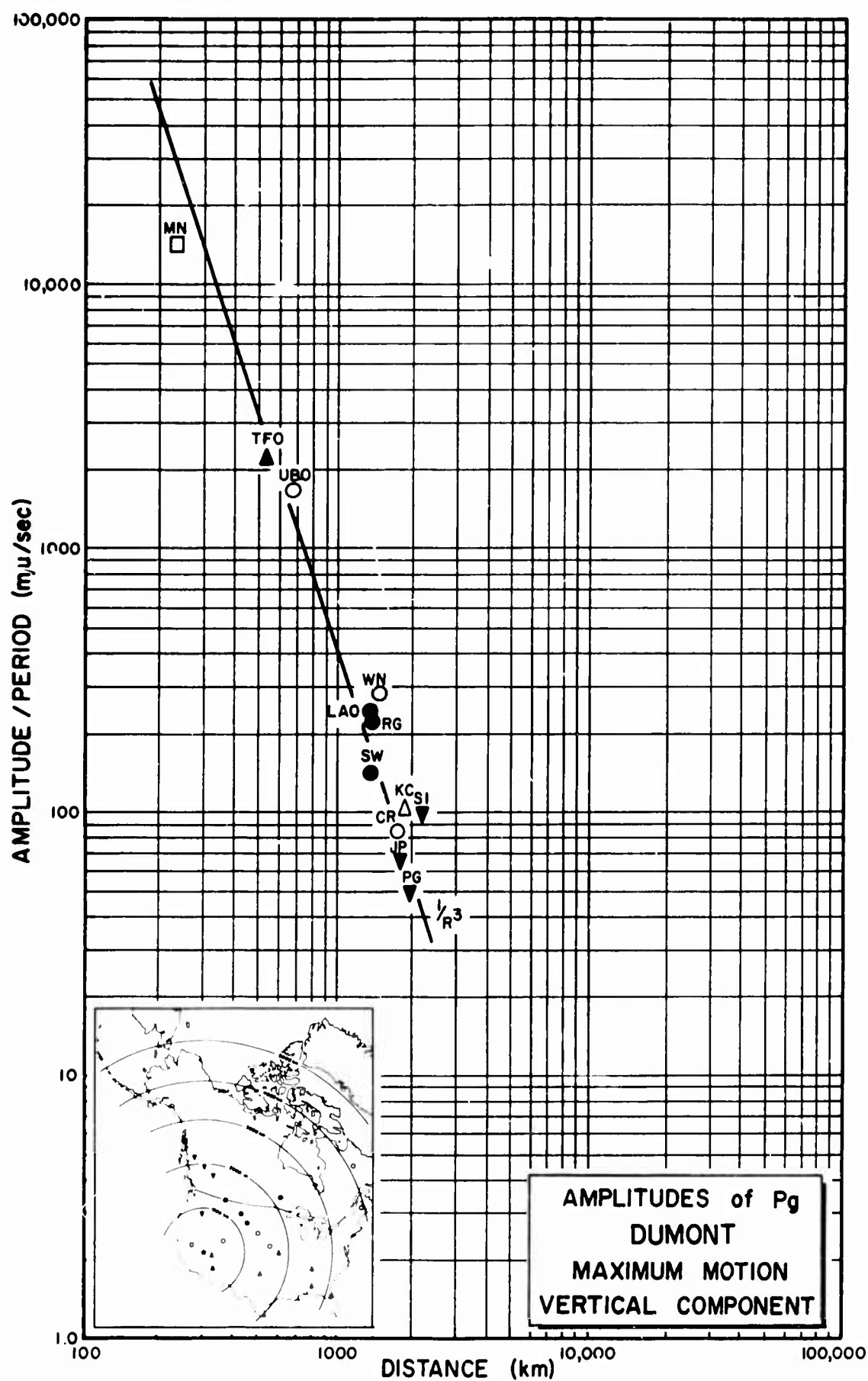


Figure 5

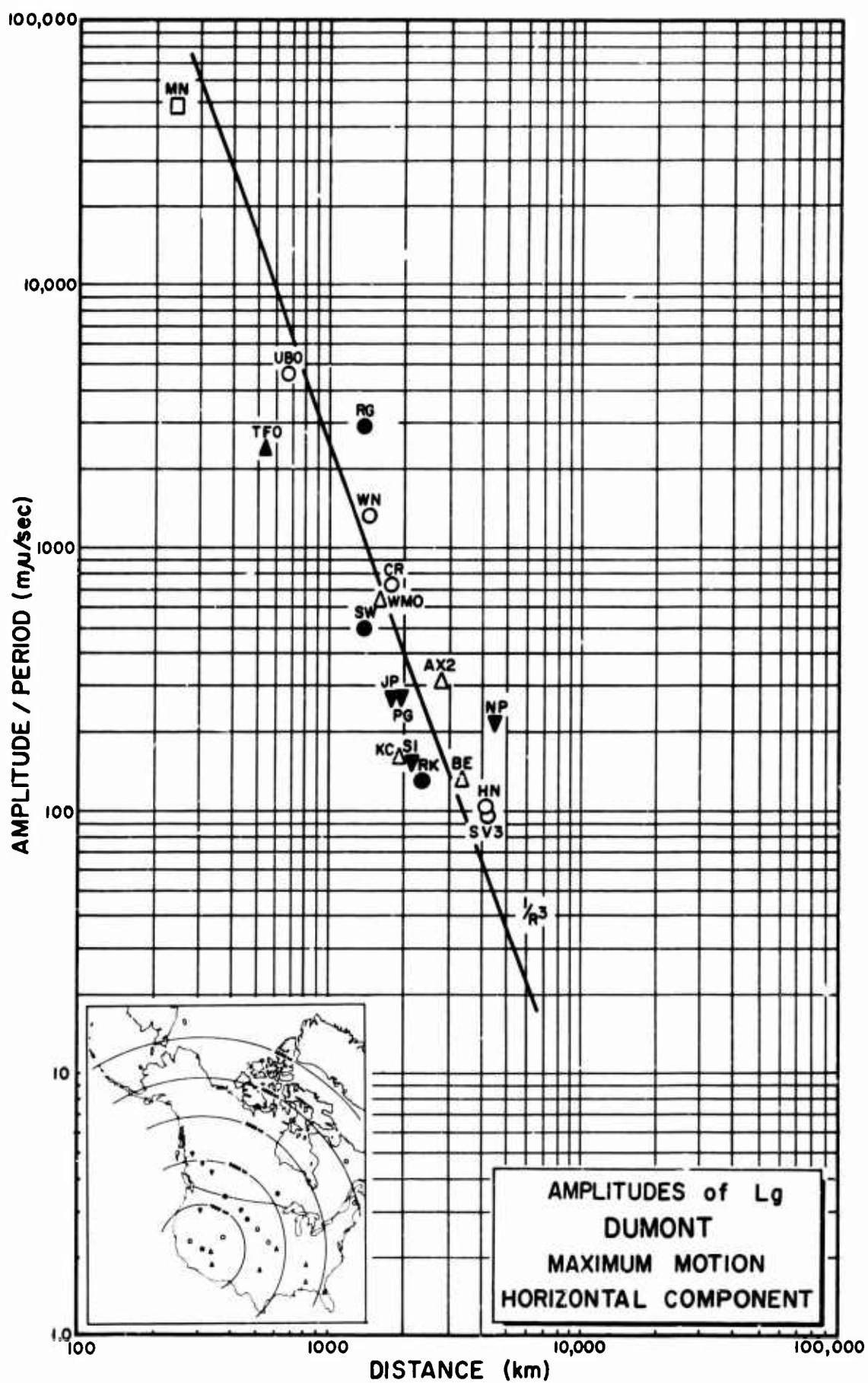


Figure 6

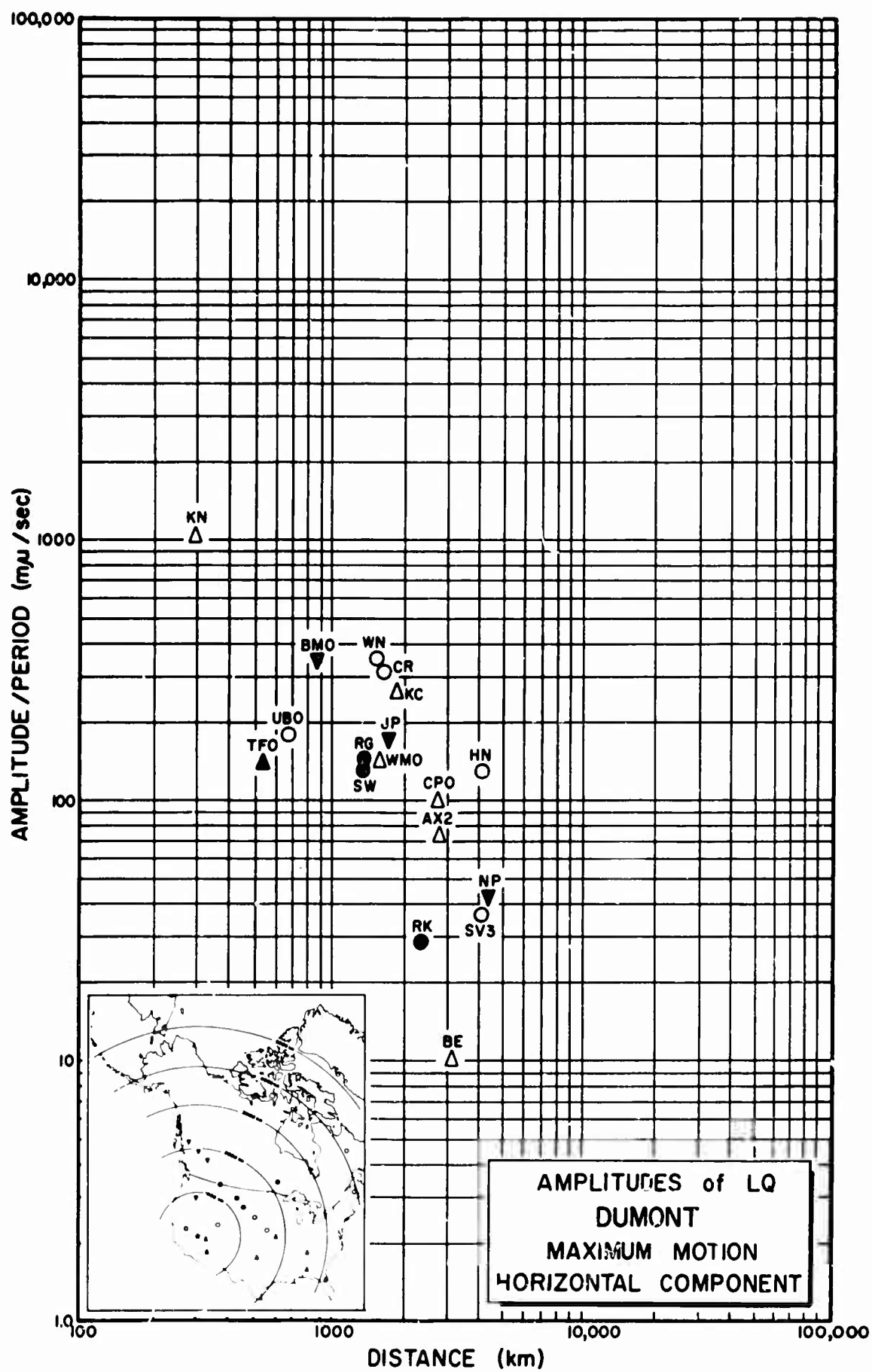


Figure 7

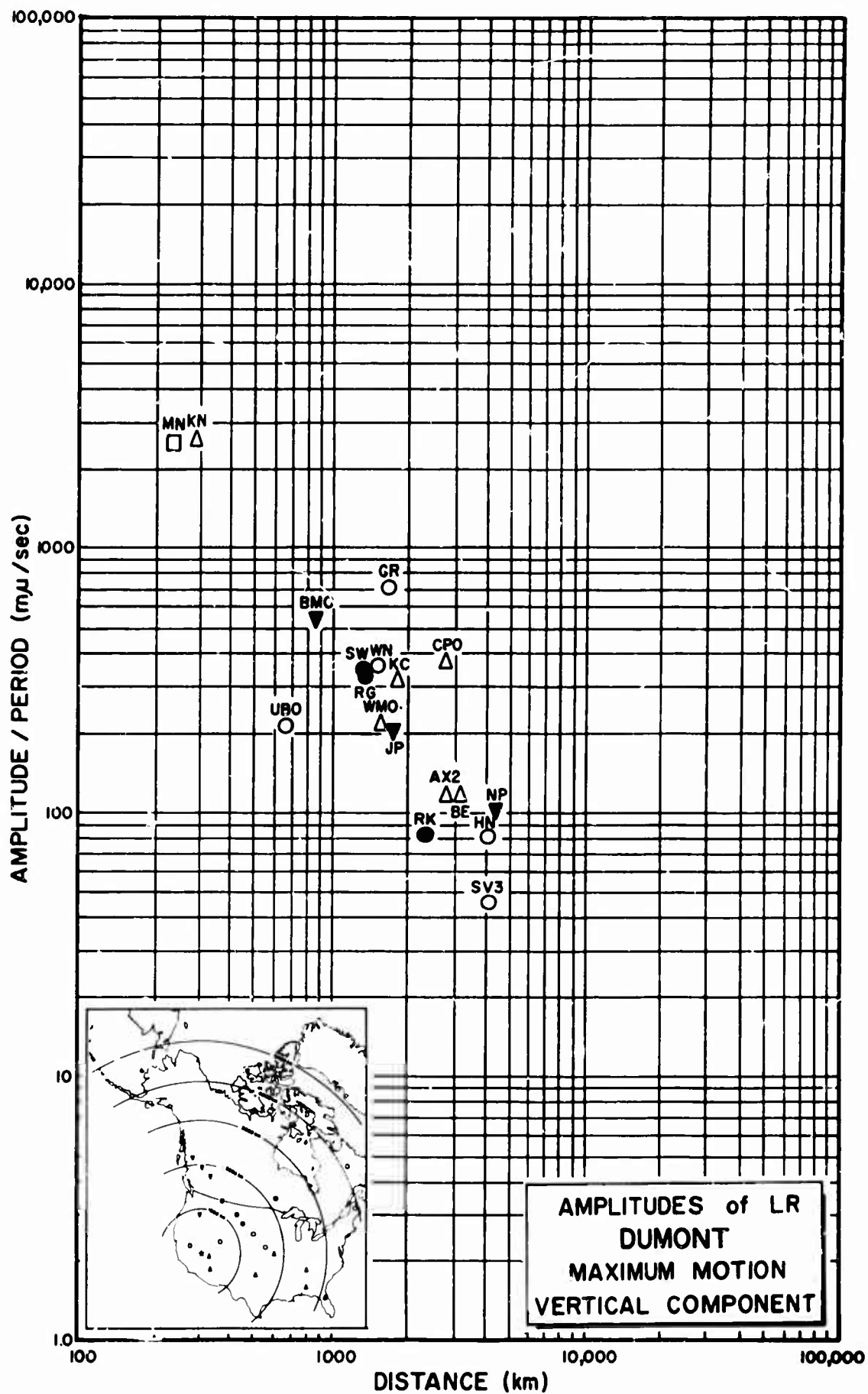


Figure 8

Code	Station	Distance (km)	Geographic Latitude	Geographic Longitude	Elev. (km)	Computed Azimuth		Installed Azimuth		Large or Small SP	LP Inst.
						Epi. Sta.	Sta. Epi.	Radial	Tanq.		
MN-NV	Mina Nevada	236	38°26'10" N	118°08'53" W	1.52	309°	128°	108°	38°	L	X
KN-UT	Kanab, Utah	287	37°01'22" N	112°40'39" W	1.74	91°	273°	95°	185°	L	X
TF50-Z1*	Tonto Forest Observatory, Arizona	535	34°17'12" N	111°16'03" W	1.49	124°	307°	90°	0°	JM	X
UB50-Z1*	Uinta Basin Observatory, Utah	667	40°19'18" N	109°34'07" W	1.60	56°	240°	90°	0°	JM	X
BM50-Z3*	Blue Mountain Observatory, Oregon	866	44°50'56" N	117°18'20" W	1.19	353°	173°	0°	90°	JM	X
LAO	Subarray AO-10, Montana	1339	46°41'19" N	106°13'20" W	.90	34°	221°			HSZ	
SW-MA*	Sweetgrass, Montana	1359	48°58'08" N	111°57'46" W	1.11	13°	196°	121°	211°	S	X
RG-SD*	Redig, South Dakota	1381	45°12'59" N	103°32'05" W	.95	45°	24°	127°	217°	L	X
WN-SD*	Winnier, South Dakota	1510	43°15'08" N	100°11'46" W	.79	58°	249°	129°	219°	L	X
WM50-Z6*	Wichita Mountain Observatory, Oklahoma	1597	34°43'05" N	98°35'21" W	.51	94°	285°	90°	0°	JM	X
CR-NB*	Crete, Nebraska	1709	40°39'52" N	96°51'15" W	.44	71°	263°	131°	221°	L	X
JP-AT*	Jasper, Alberta, Canada	1762	52°53'50" N	118°05'25" W	1.13	355°	174°	114°	204°	L	X
KC-MO*	Kansas City, Missouri	1885	39°21'21" N	94°40'17" W	.27	76°	269°	133°	223°	S	X
PG-BC*	Prince George, British Columbia, Canada	1943	53°59'50" N	122°31'23" W	.91	347°	163°	110°	200°	L	X
SI-BC*	Smithers, British Columbia, Canada	2138	54°47'18" N	127°04'17" W	.58	340°	152°	107°	197°	L	X
RK-ON	Red Lake, Ontario, Canada	2341	50°50'20" N	93°40'20" W	.37	42°	238°	58°	148°	S	X
CP50-Z8*	Cumberland Plateau Observatory, Tennessee	2730	35°35'41" N	85°34'13" W	.57	84°	283°	90°	0°	JM	X
AX2AT*	Alexander City, Alabama	2764	32°46'36" N	86°07'48" W	.23	91°	288°	138°	228°	L	X
BE-FL*	Bellevue, Florida	3285	28°54'19" N	82°03'52" W	.02	96°	294°	140°	230°	S	X
HN-ME	Houlton, Maine	4066	46°09'43" N	67°59'09" W	.21	60°	273°	93°	183°	S	X
SV3QB*	Schefferville, Quebec, Canada	4188	54°48'39" N	66°45'10" W	.58	46°	263°	139°	229°	S	X
NP-NT	Mould Bay, Northwest Territories, Canada	4366	76°15'08" N	119°22'18" W	.06	359°	176°	356°	86°	JM2 S	X

* Seismometers not orientated toward Nevada Test Site

Recording Site Information - DUMONT

Appendix I(A)

Unified Magnitude: $m = \log_{10} (A/T) + B$

where

A = zero to peak ground motion in millimicrons
 $= \frac{(\text{mm}) (1000)}{K}$

K

T = signal period in seconds

B = distance factor (see Table below)

mm = record amplitude in millimeters zero to peak

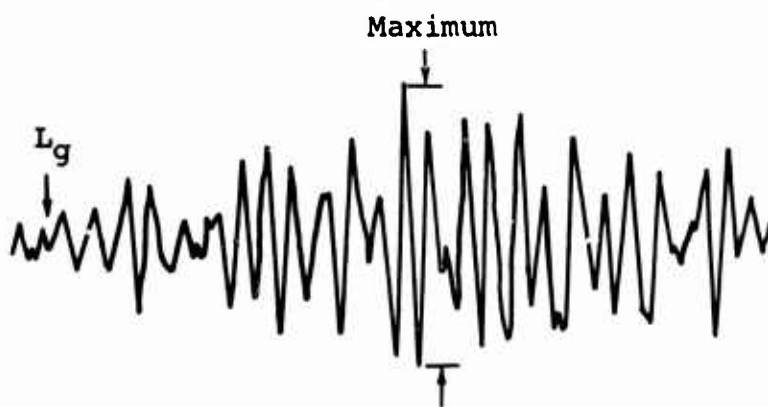
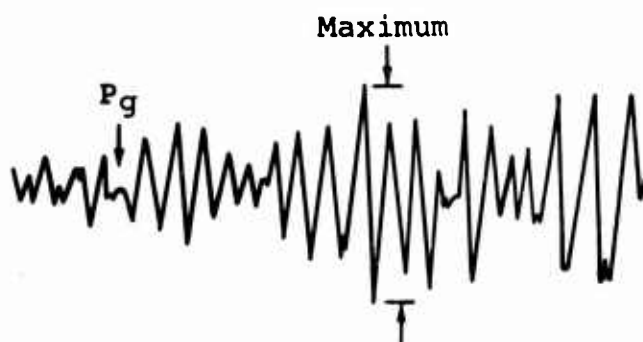
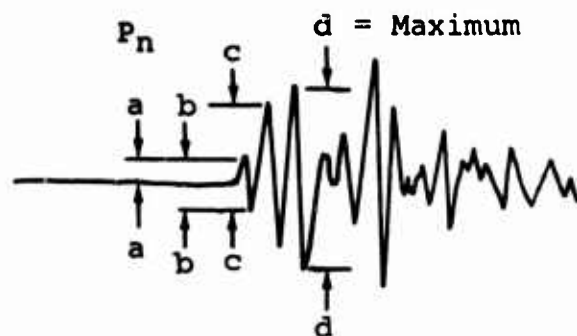
K = magnification in thousands at signal frequency

Table of Distance Factors (B) for Zero Depth

Dist (deg)	B	Dist (deg)	B	Dist (deg)	B	Dist (deg)	B
0°	-	27°	3.5	54°	3.8	80°	3.7
1	-	28	3.6	55	3.8	81	3.8
2	2.2	29	3.6	56	3.8	82	3.9
3	2.7	30	3.6	57	3.8	83	4.0
4	3.1	31	3.7	58	3.8	84	4.0
5	3.4	32	3.7	59	3.8	85	4.0
6	3.6	33	3.7	60	3.8	86	3.9
7	3.8	34	3.7	61	3.9	87	4.0
8	4.0	35	3.7	62	4.0	88	4.1
9	4.2	36	3.6	63	3.9	89	4.0
10	4.3	37	3.5	64	4.0	90	4.0
11	4.2	38	3.5	65	4.0	91	4.1
12	4.1	39	3.4	66	4.0	92	4.1
13	4.0	40	3.4	67	4.0	93	4.2
14	3.6	41	3.5	68	4.0	94	4.1
15	3.3	42	3.5	69	4.0	95	4.2
16	2.9	43	3.5	70	3.9	96	4.3
17	2.9	44	3.5	71	3.9	97	4.4
18	2.9	45	3.7	72	3.9	98	4.5
19	3.0	46	3.8	73	3.9	99	4.5
20	3.0	47	3.9	74	3.8	100	4.4
21	3.1	48	3.9	75	3.8	101	4.3
22	3.2	49	3.8	76	3.9	102	4.4
23	3.3	50	3.7	77	3.9	103	4.5
24	3.3	51	3.7	78	3.9	104	4.6
25	3.5	52	3.7	79	3.8	105	4.7
26	3.4	53	3.7				

Unified Magnitudes from Pn or P Waves

Appendix I(B)

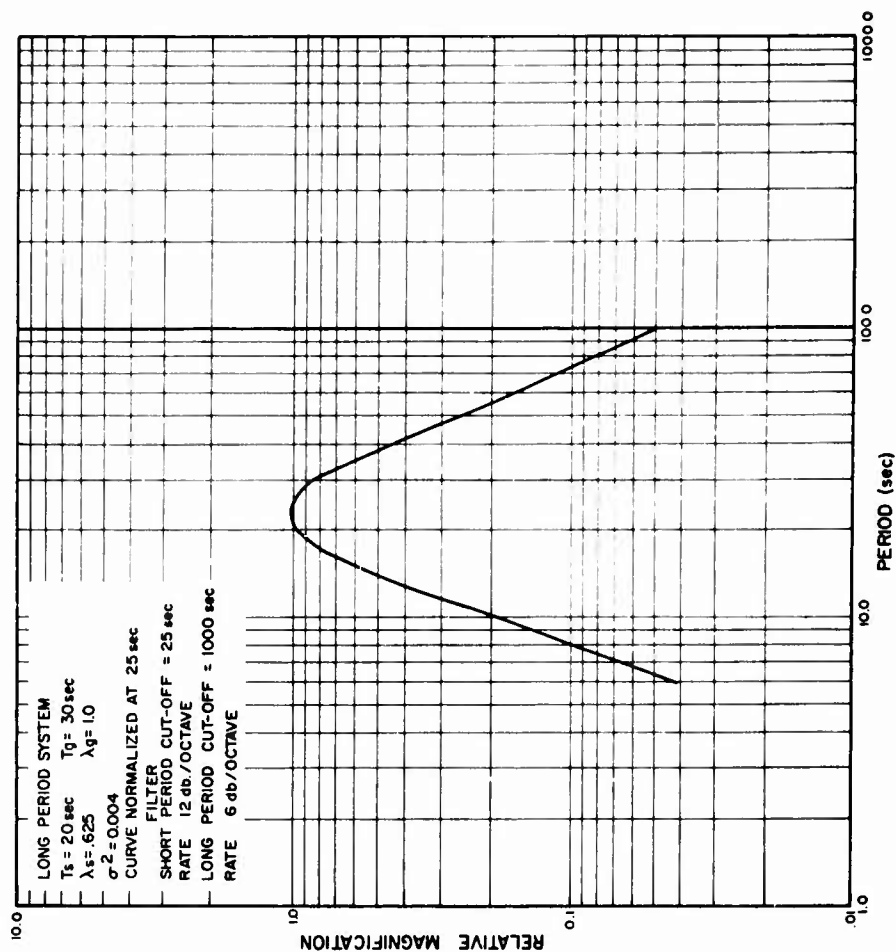
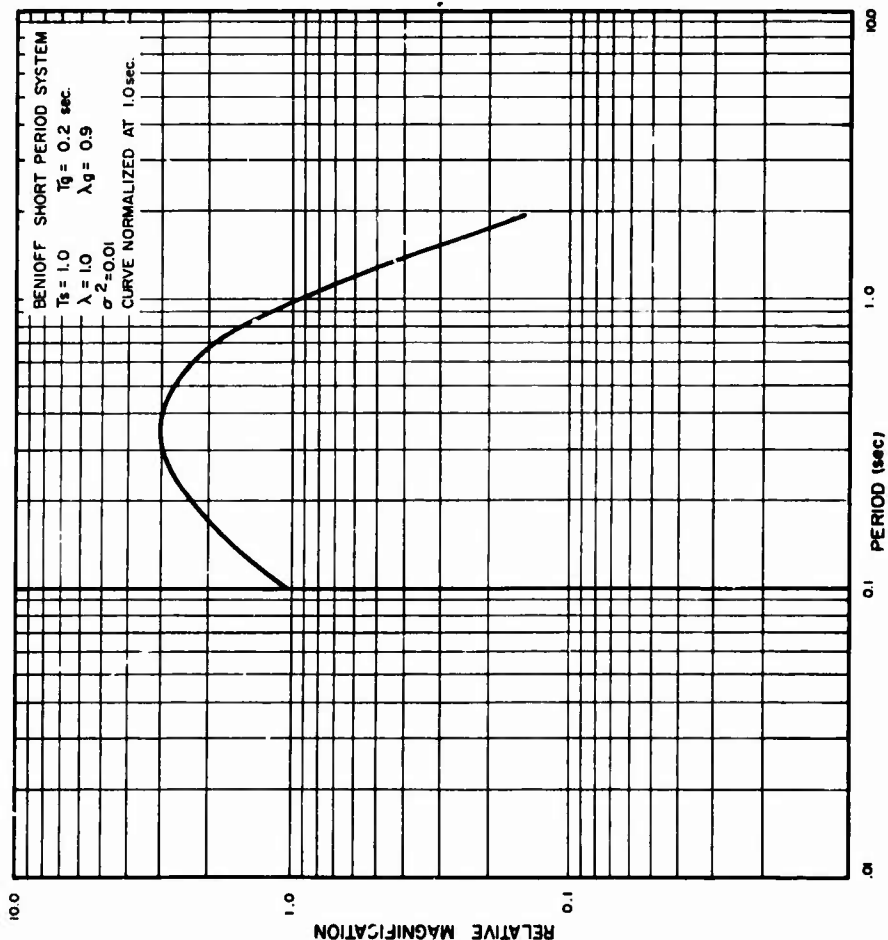


Detail Showing Allowance
For Line Width

Pick time of Pn at beginning of "a" half cycle.

Pick amplitude of Pn as maximum " $d/2$ " within 2 or 3 cycles of "c".

Pick amplitudes of Pg and Lg at maximum of corresponding motion.



INSTRUMENT RESPONSE CURVES - LRSM

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DOCUMENT CONTROL DATA - R&D		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)		
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		2b. GROUP
		--
3. REPORT TITLE		
Long Range Seismic Measurements - DUMONT		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)		
Scientific Report		
5. AUTHOR(S) (Last name, first name, initial)		
Clark, Don M.		
6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
15 September 1966	20	1
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)	
AF 33(657)-15919	SDL Report No. 160	
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--		ADVANCED RESEARCH PROJECTS AGENCY NUCLEAR TEST DETECTION OFFICE WASHINGTON, D. C.
13. ABSTRACT		
<p>An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases.</p>		

DD FORM 1473
1 JAN 64

Unclassified
Security Classification

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Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Seismic Magnitude						
Seismic Travel-Time						
Seismic Amplitude						
VELA-UNIFORM						
Nuclear Tests						

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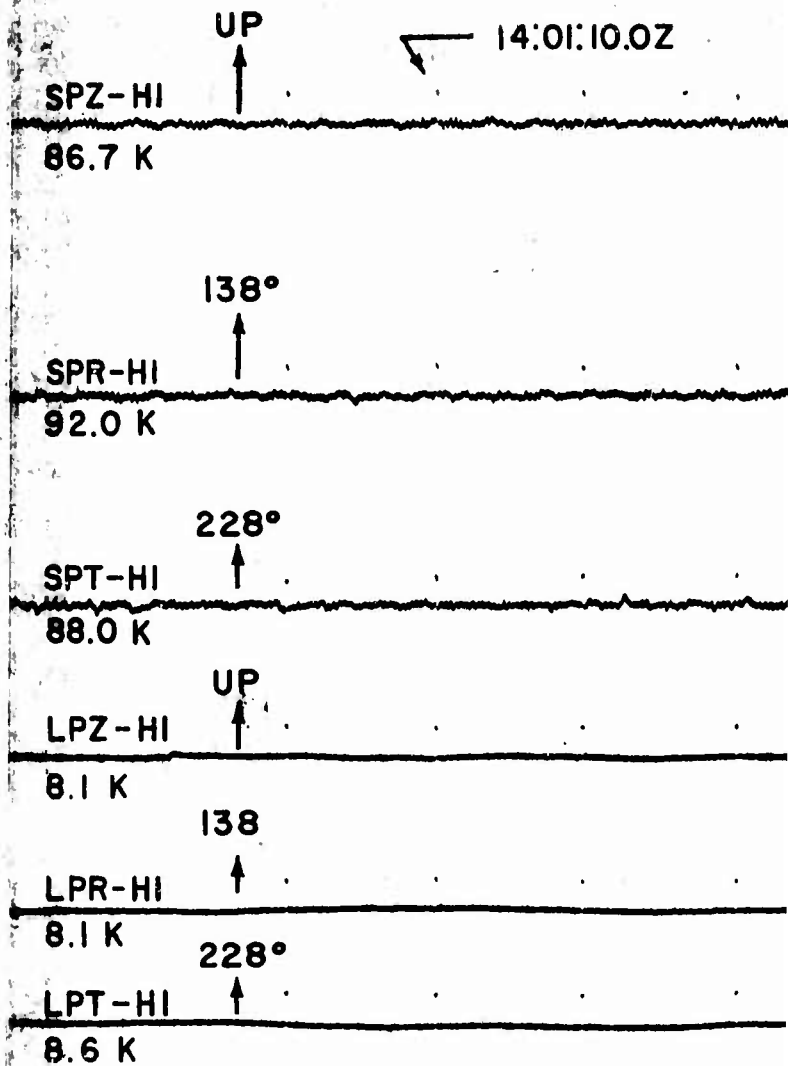
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AX2AL

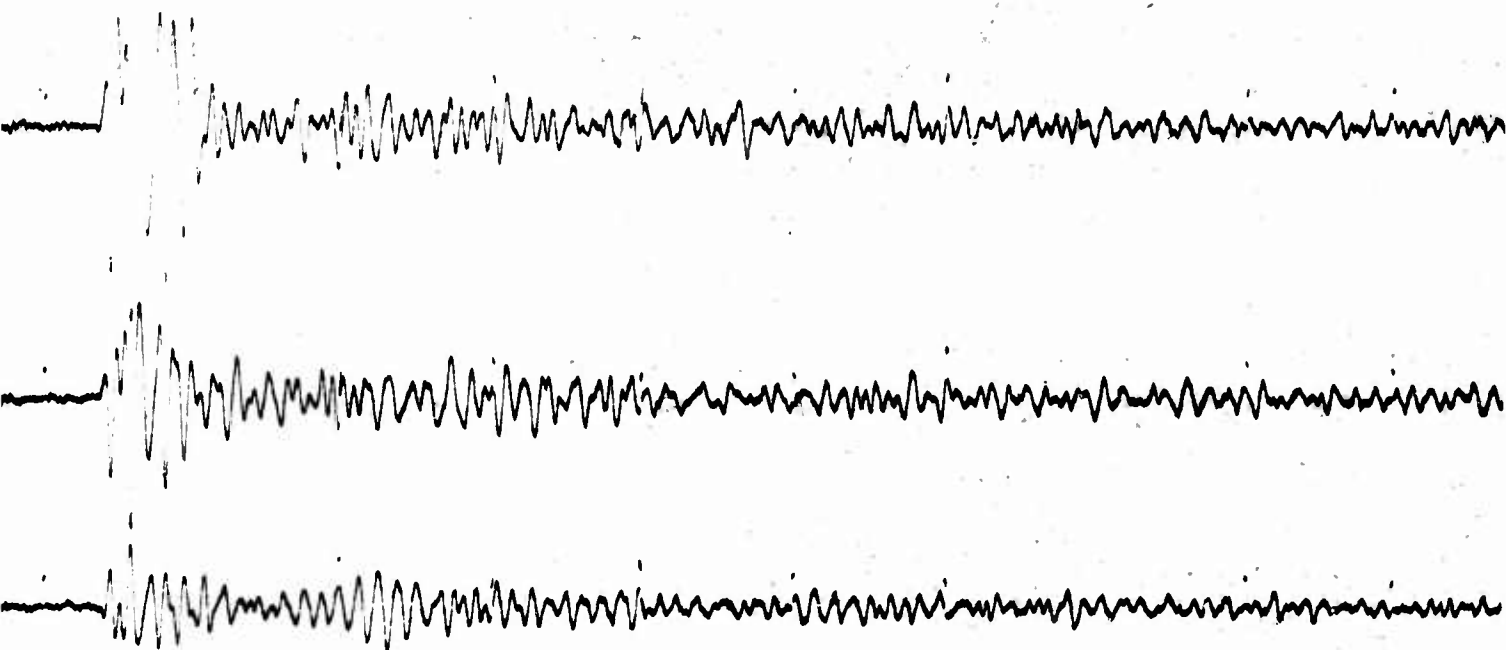
ALEXANDER CITY, ALABAMA

19 MAY 1966

$\Delta=2764$ km



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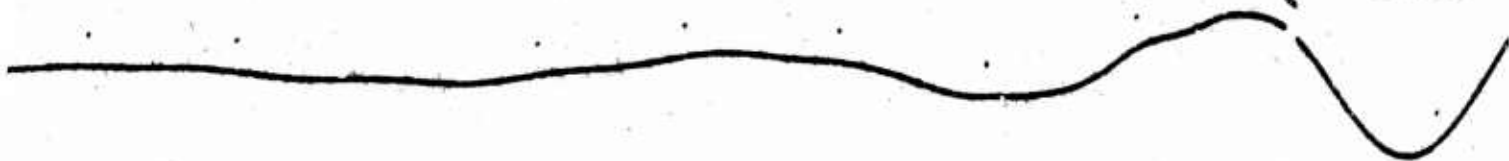
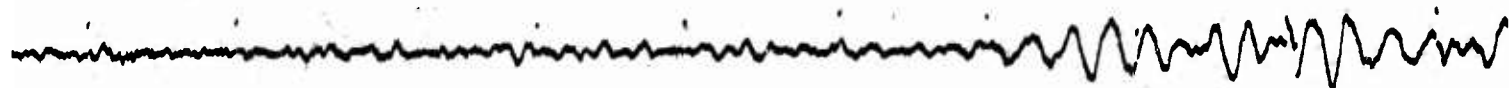
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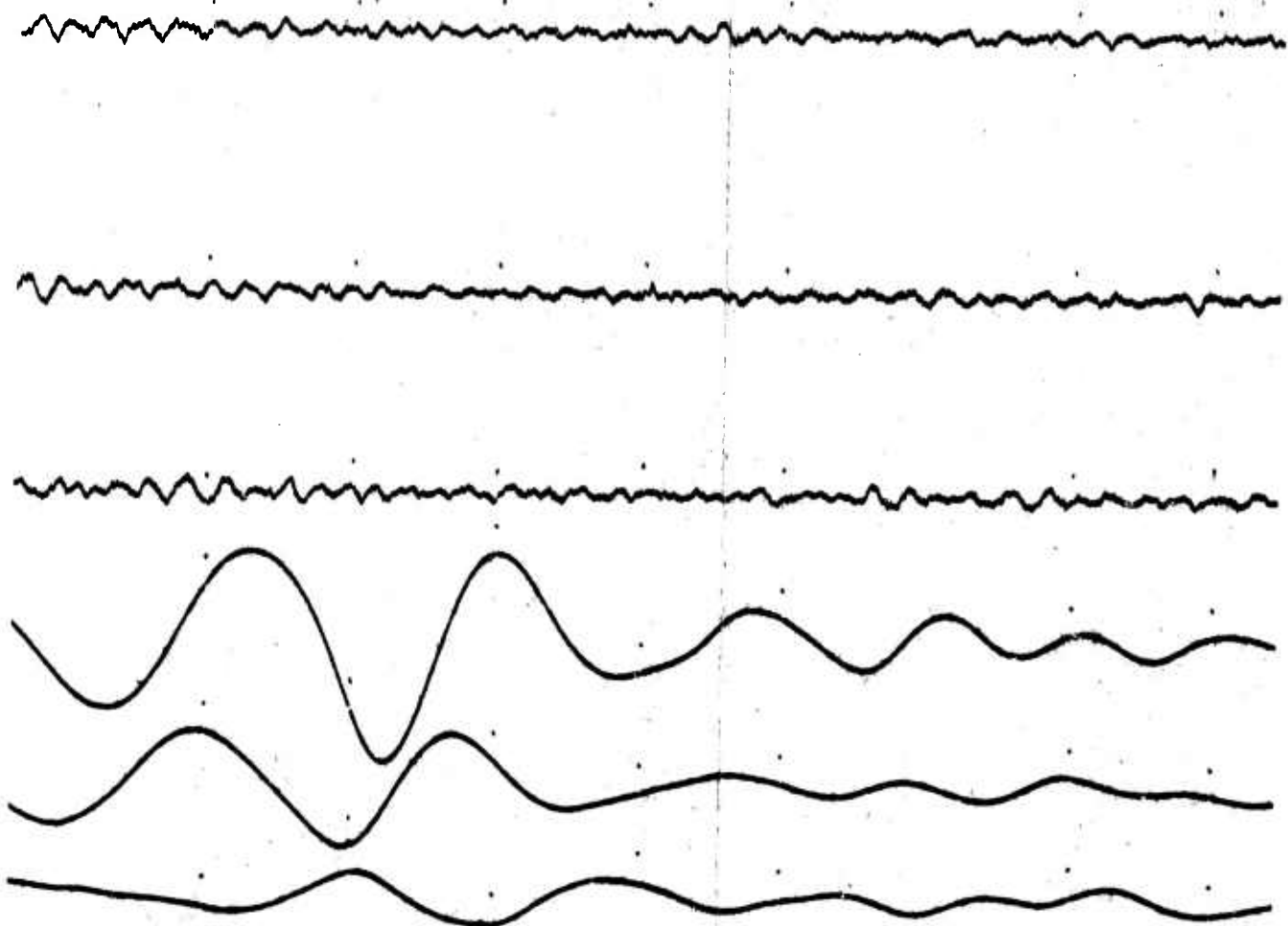
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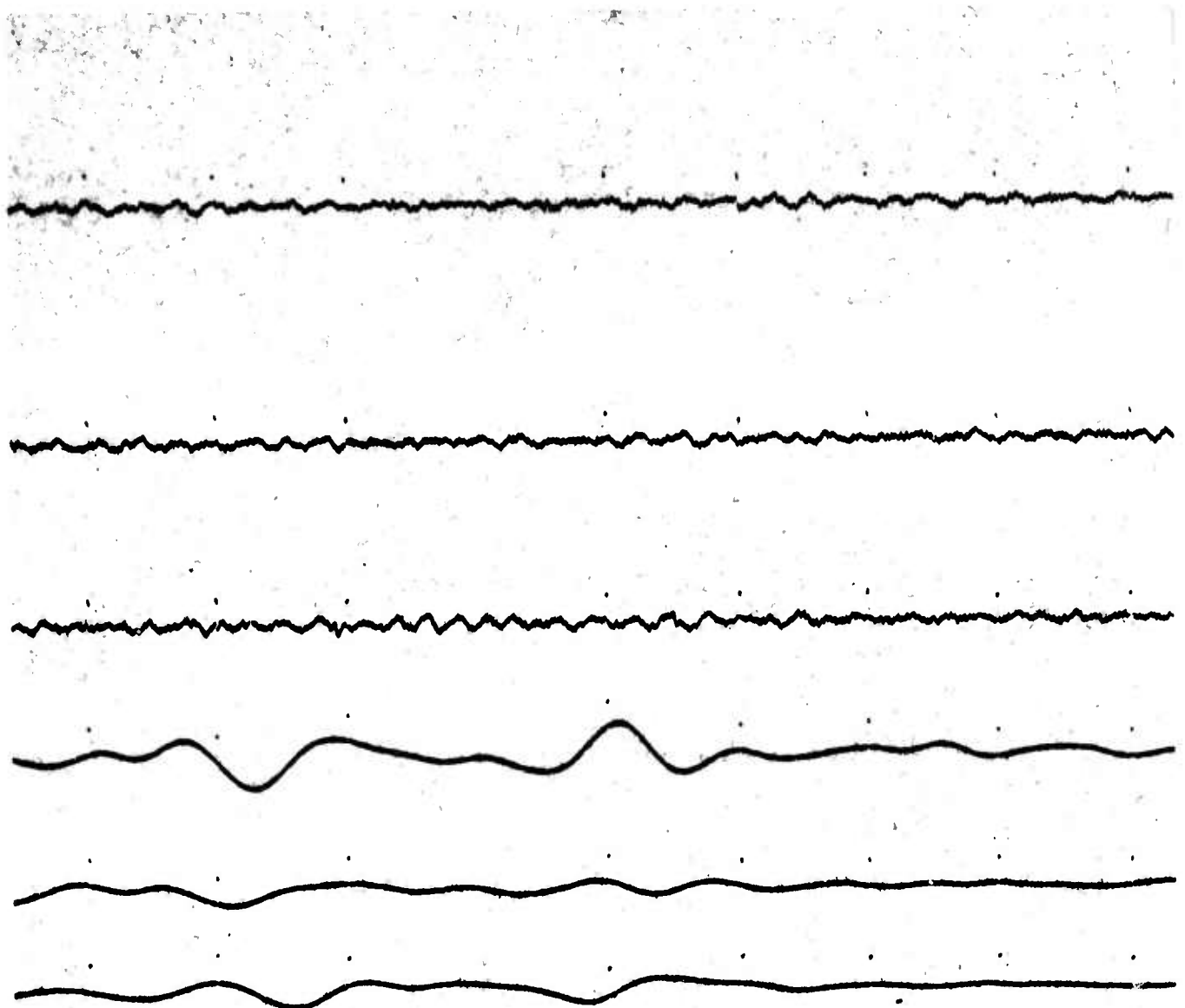
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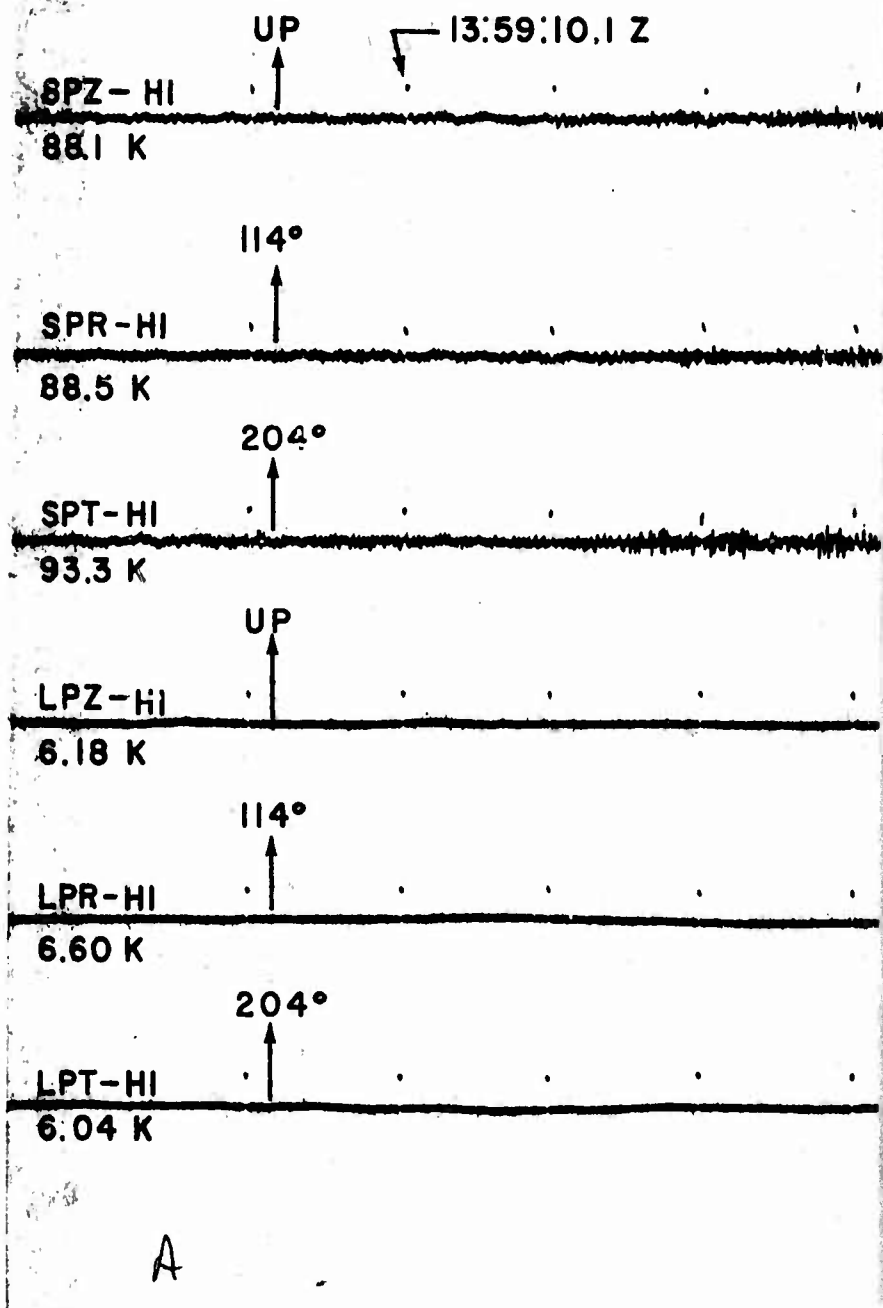
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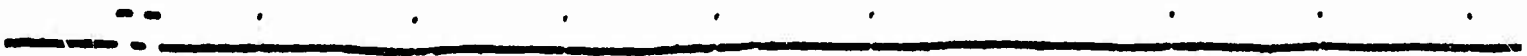
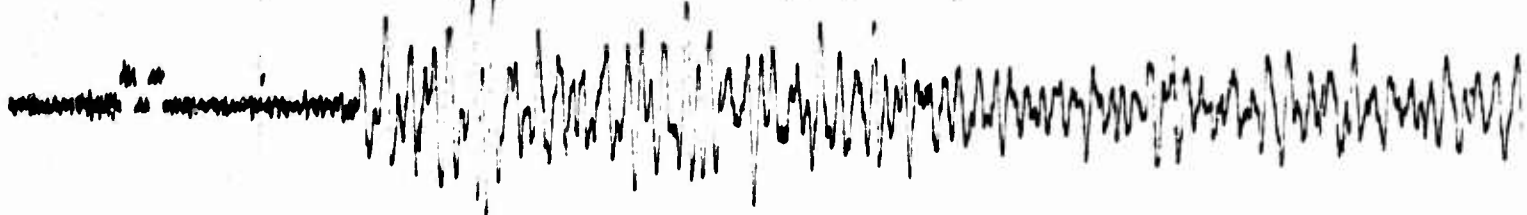
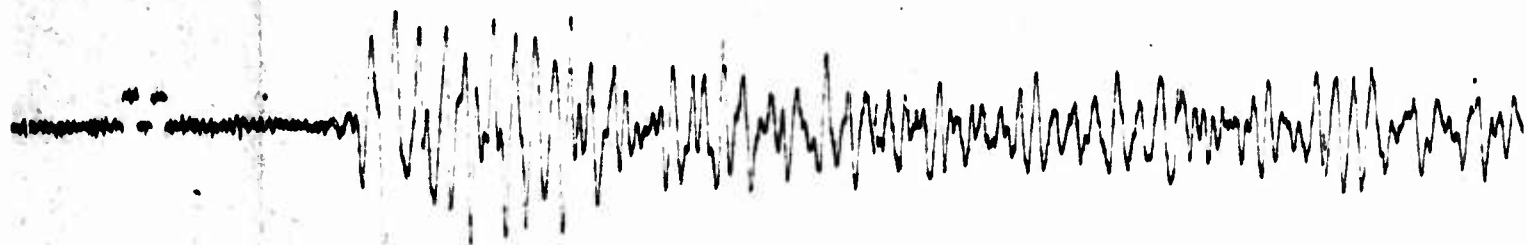
JP - AT

JASPER, ALBERTA, CANADA

19 MAY 1966

$\Delta = 1762$  km





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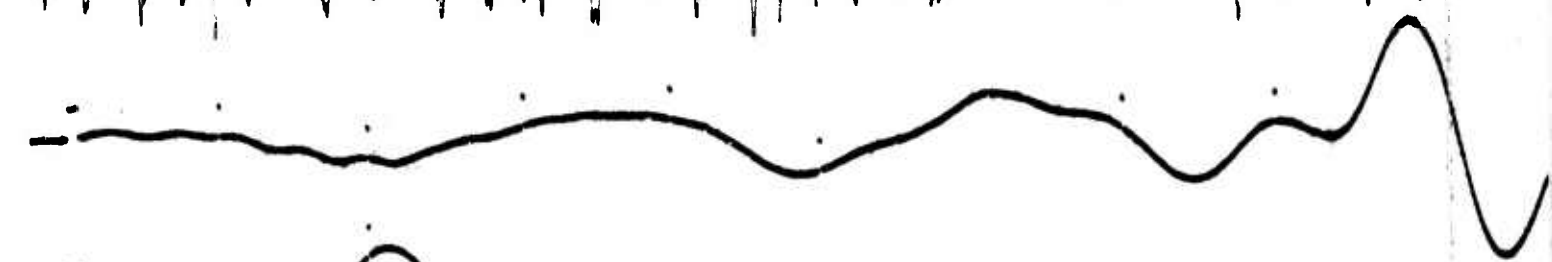
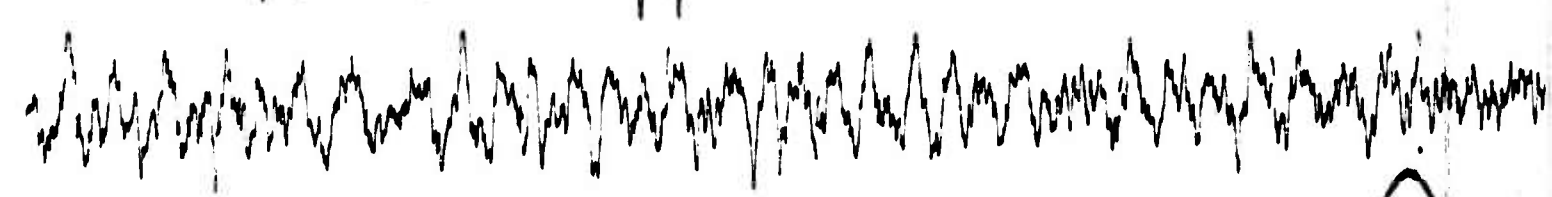
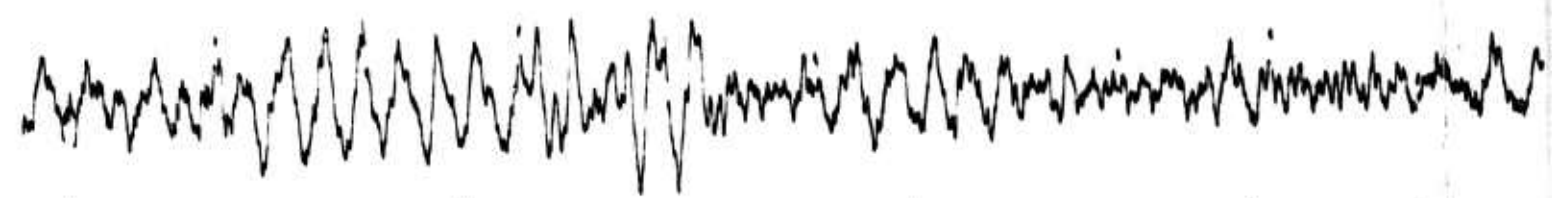
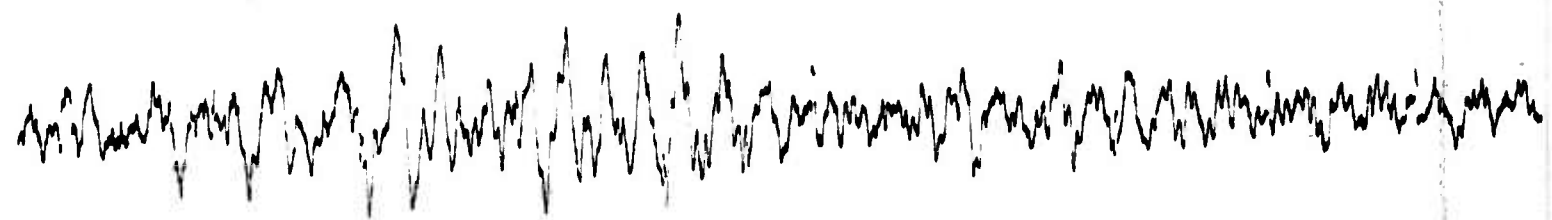
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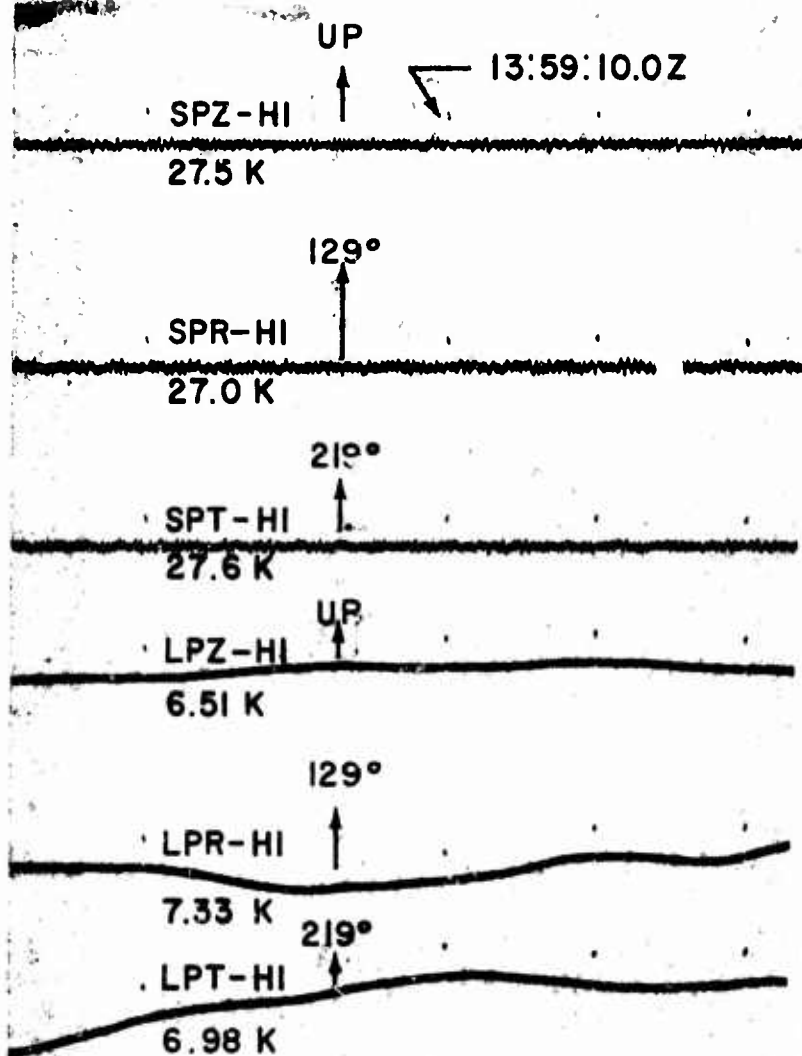
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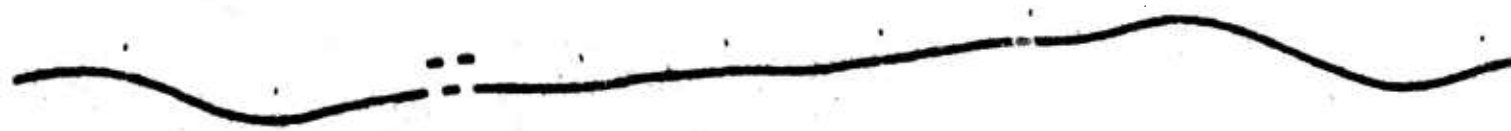
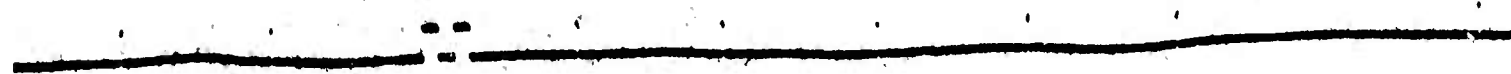
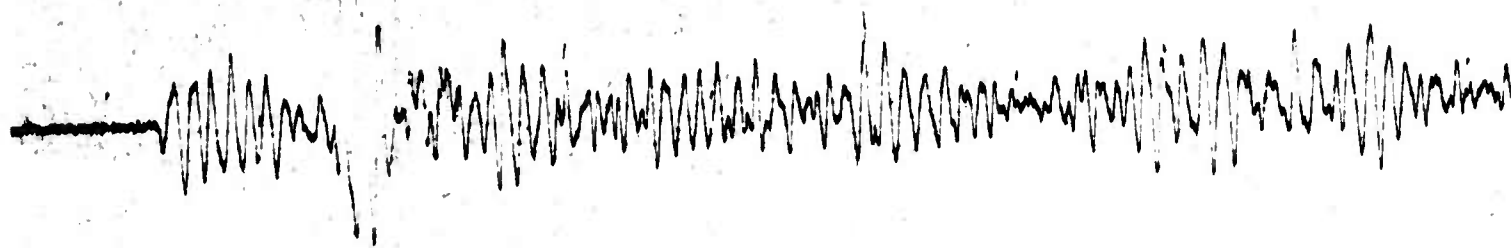
WN-SD

WINNEP SOUTH DAKOTA

19 MAY 1966

$\Delta = 1510$  km





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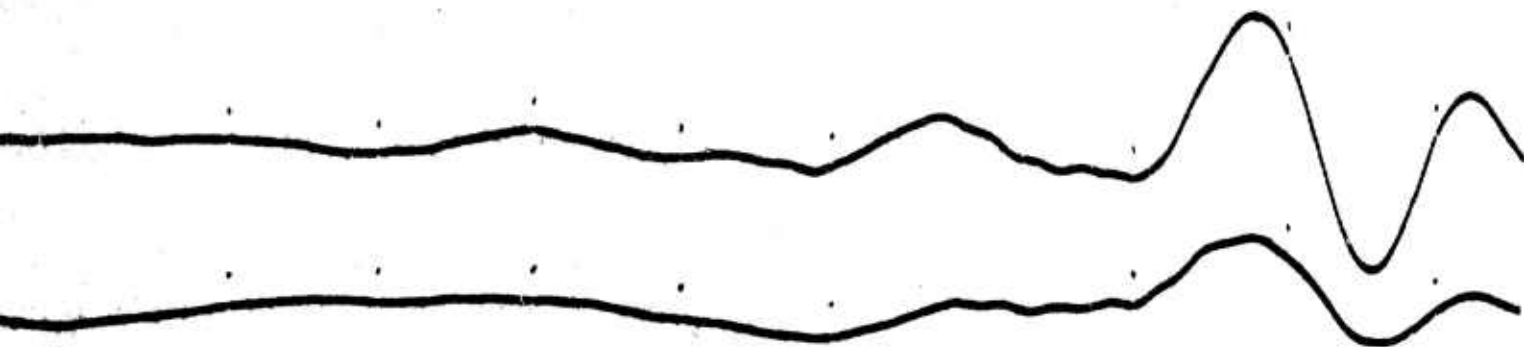
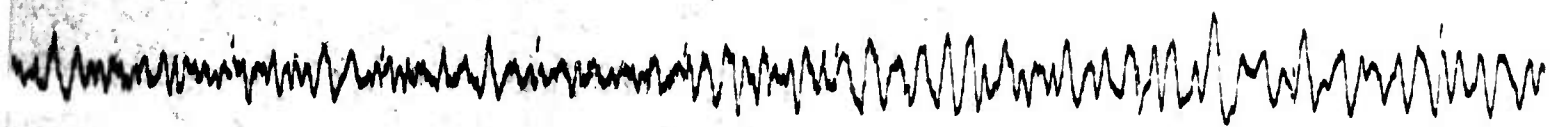
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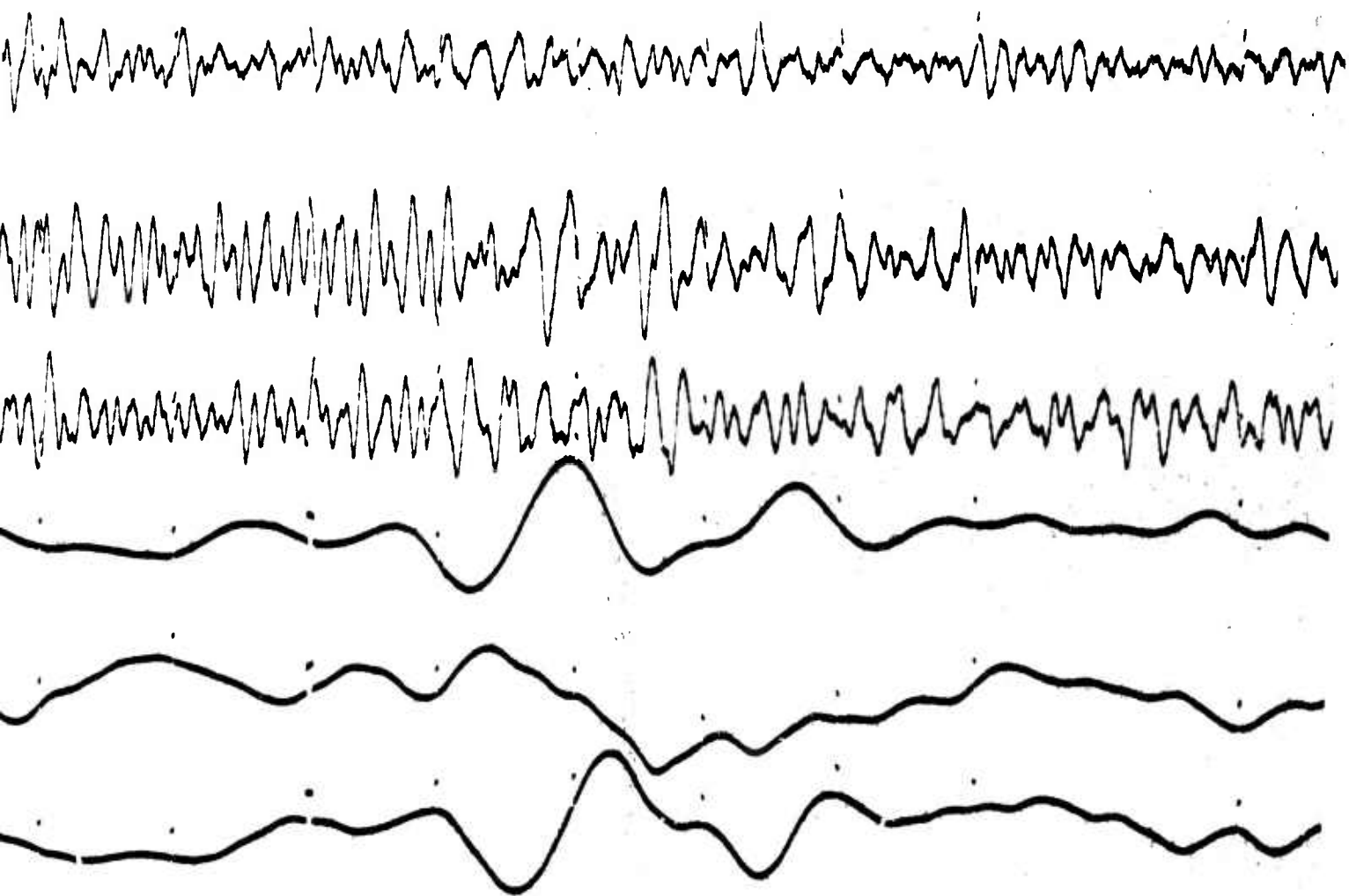
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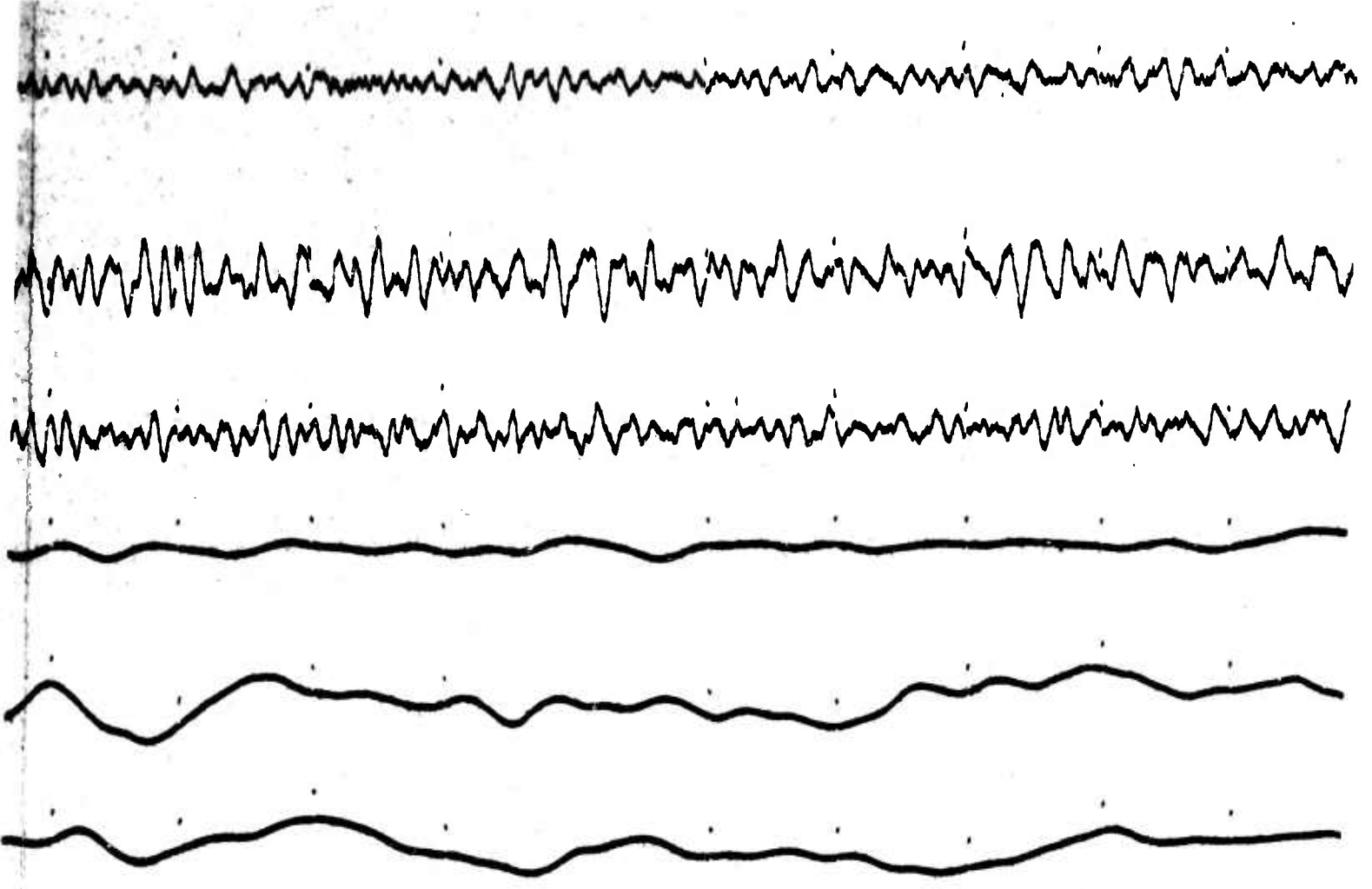
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DUMONT  
MN - NV  
MINA, NEVADA  
19 MAY 1966  
 $\Delta = 236$  km

SPZ-LO    UP    13:56:20.0Z  
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SPR-LO    308°  
0.44 K

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SPT-LO    38°  
0.42 K

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LPZ-LO    UP  
0.46 K

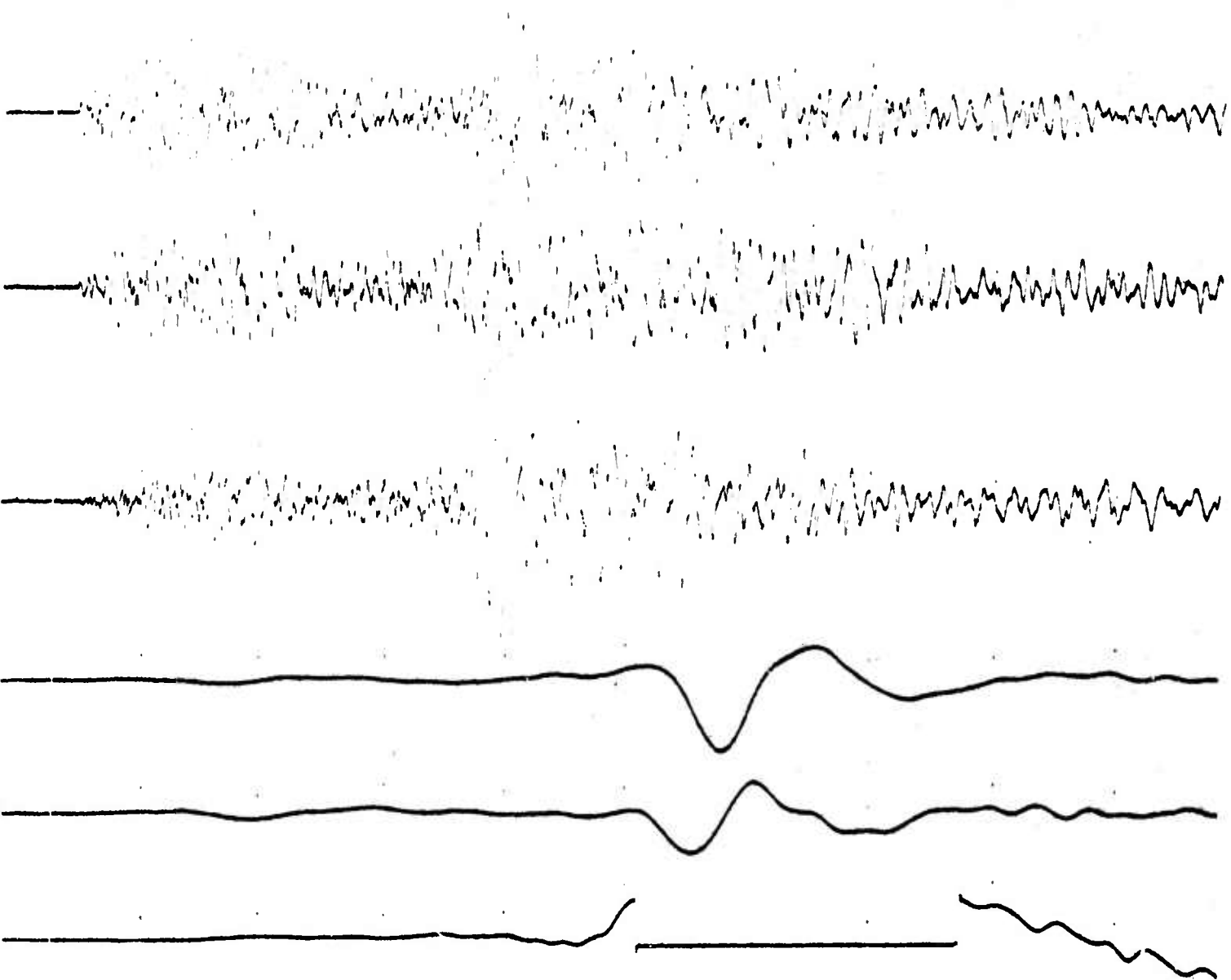
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LPR-LO    308°  
0.31 K

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LPT-HI    38°  
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